



**THE
ONTARIO WATER RESOURCES
COMMISSION**

REPORT ON

WATER POLLUTION SURVEY

KINGSTON AREA

A SURVEY OF OUTFALLS TO LAKE ONTARIO,
THE ST. LAWRENCE RIVER AND THEIR TRIBUTARIES
ALONG THE FRONT OF FRONTENAC COUNTY.

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Report on

WATER POLLUTION SURVEY, KINGSTON AREA

A Survey of Outfalls to
Lake Ontario, the St. Lawrence River and their
Tributaries along the front of Frontenac County

with pertinent
Sanitary Survey Reports

on

City of Kingston
Township of Kingston
Township of Pittsburgh

EY:

R. Barrens, C.S.I.(C.),
Engineer's Assistant.

Supervised by:

G. Kay, P. Eng.,
District Engineer.

Date

1959

A REPORT ON WATER POLLUTION SURVEY, KINGSTON AREA

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WATER POLLUTION SURVEY, KINGSTON AREA

A Survey of Outfalls to Lake Ontario, the St. Lawrence River and their Tributaries along the front of Frontenac County

Chapter 1

Introduction

This report deals with a survey which was conducted during 1959 to locate actual and potential sources of pollution with respect to Lake Ontario, the St. Lawrence River and their tributaries along the front of Frontenac County. Initial investigations were conducted during the period of January 20th to February 20th, 1959. Further investigations and an intensive sampling programme were carried out during the period of May 27th to August 26th, 1959.

This survey was concerned mainly with the Lake Ontario-St. Lawrence waterway which extends past the front of Frontenac County, as well as pertinent sanitary surveys of portions of the City of Kingston, the Township of Kingston and the Township of Pittsburgh which are drained either to this waterway or to tributaries thereof.

Geography of Area

The three(3) principal drainage systems in the southern part of Frontenac County are tributaries of the Lake Ontario-St. Lawrence River waterway, and are:

The Cataraqui River- Rideau Canal System
Cataraqui Creek
Collins Creek

The Cataraqui River forms the boundary between the City of Kingston and the Township of Pittsburgh. Cataraqui Creek, in part, separates the City of Kingston from the Township of Kingston. Collins Creek has its source within the Township of Kingston and flows in a south-westerly direction to its mouth at Collins Bay.

Geology of Area

The Cataraqui River is considered to be a natural division between the Grenville limestone formation on the west and the granite formation of the Pre-Cambrian Shield on the east. In that part of Frontenac County lying west of the Cataraqui River, the limestone is found to be fissured, and is thinly covered with heavy clay of an impervious nature. This heavy clay soil ranges in depth over the rock from a few inches to a few feet, and provides very unsuitable conditions for the satisfactory operation of septic tank systems. The fissured limestone in the area and the clay soil of poor absorptive characteristics, can cause ground waters to become polluted and inadequately treated sanitary wastes to be carried to local watercourses.

Economic Growth

By annexation in 1952, the City of Kingston was enlarged to include the Village of Portsmouth and a portion of the Township of Kingston. Both of these municipalities have experienced much industrial and residential growth during recent years. Figures on population growth, as well as projected

population figures for the City of Kingston were obtained from the Department of Economics, Ontario, and the City of Kingston Planning Board. They are as follows:

	<u>1951(before annexation)</u>	<u>1956(following annexation)</u>	<u>1959</u>	<u>1980 presumed</u>
City of Kingston	33,459	46,618	51,000	74,000
Twp.of Kingston	8,990	5,191	8,000	45,000
Twp.of Pittsburgh	3,467	4,481	3,500	14,000
Village of Portsmouth	3,411	--	--	--

General

Investigations of this type are made by The Ontario Water Resources Commission in its programme to control pollution of all surface and ground waters. The procedure followed is to examine the waters and all sources of pollution, and to take the necessary steps where there is impairment of the quality of the water. In this way an effort is made to ensure that water quality will be suitable for domestic, industrial and agricultural purposes, the support of fish and wildlife, and use for recreation, navigation, and all riparian requirements.

Discussions were held at the outset with officials of the various municipalities which were concerned in this survey. Enquiries were made to determine the amount of industrial activity in the area, and the disposal of storm water, process water, and sanitary wastes as they might affect the quality of the receiving waters. Maps were obtained from various sources.

The co-operation which was received from the City of Kingston Health Department, municipal officials as listed below, and from other parties interviewed during the investigations is appreciated:

Mr.T.J.McKibbin, Kingston, City Clerk;

Mr.D.P.Ross, Kingston, City Engineer and Commissioner of Works;

Mr.J.D.Graham, Kingston, Deputy City Engineer;

Mr.M.Wade, Kingston, Engineer in charge of Sewage Works;

Mr.Richard Porter, Kingston, Superintendent of the Sewerage System;

Mr.H.Saunders, Kingston, Superintendent of the Kingston Water Purification Plant;

Dr.R.A.Kelly, Kingston, Medical Officer of Health for the City of Kingston;

Mr.R.M.MacPherson, Sanitary Inspector, City of Kingston Health Department;

Mr.Colin J.MacLean, R.R.1, Kingston, Clerk of the Township of Pittsburgh;

Dr.K.B.Suddaby, Kingston, Medical Officer of Health for the Township of Pittsburgh;

Mr.P.D.Stevenson, Cataraqui, Clerk of the Township of Kingston;

Dr.N.V.Freeman, Battersea, Medical Officer of Health for the Township of Kingston;

Mr.Thomas Burtch, R.R.1, Collins Bay, Building Inspector for Township of Kingston.

Sampling Procedure

Sampling points are shown on the appended map of the front of Frontenac County, as well as on the maps of the respective municipalities. These locations were selected to

provide essential information on the quality of the waters of the streams and their associated tributaries. "Grab" samples were collected: forty (40) ounce samples being used for sanitary chemical analyses, and six(6) ounce samples for bacteriological analyses. Tests were conducted at the Ontario Water Resources Commission laboratory, 46 Wellesley Street West, Toronto. The results of stream and outfall samples are shown in Tables I to X inclusive.

The most common analyses of sanitary significance are: Biochemical Oxygen Demand, Suspended Solids, and the bacteriological determination expressed either as a Total Coliform County(Indicated Number) or as a Membrane Filter Coliform Count.

Biochemical Oxygen Demand(B.O.D.)

The B.O.D. of sewage, sewage effluent, polluted waters or industrial wastes is the oxygen required during stabilization(natural purification in a stream) of the decomposable organic matter or chemical material by aerobic biochemical action. Unless otherwise noted, a five-day B.O.D. determination is reported. A high B.O.D. is indicative of organic or chemical pollution. A desirable upper limit in natural water commonly is four (4) parts per million.

Suspended Solids

These results are reported in parts per million and indicate the measure of undissolved solids of organic or inorganic nature. Where suspended solids values approached 20 parts per million or less, laboratory difficulties usually

result in these values being determined as turbidity and are reported in silica units.

Total Coliform Count

This count is reported per 100 millilitres and indicates bacteriological contamination by human or animal excrement or by some nonfaecal forms. A coliform count of less than 1,000 organisms, Indicated Number, is considered desirable in streams.

Membrane Filter Coliform Count

The membrane filter technique is employed to obtain a direct enumeration of coliform organisms and also is reported per 100 millilitres. A membrane filter coliform count in excess of the desirable upper limit of 2,400 organisms is considered to render the waters undesirable for municipal water supplies and bathing purposes.

Additional specific tests are employed to determine the nature and significance of industrial waste discharges.

Sampling Programme

Two(2) separate sampling programmes were conducted during this survey to show the bacteriological and sanitary chemical qualities of the waters in Lake Ontario and the St. Lawrence River along the front of Frontenac County.

On June 10th and 11th, 1959, samples were collected from an area extending from the Brother Islands at the western limits of Frontenac County, to Milton Island near the eastern limits, which is located approximately one(1) mile downstream from the City of Kingston sewage treatment plant. Sample

results are shown in Table I.

An additional sampling programme was conducted on August 26th, 1959, when sampling was confined to the St. Lawrence River in the vicinity of the City of Kingston sewage treatment plant in Pittsburgh Township. Samples were collected on this date primarily to ascertain if the effluent from this sewage treatment plant was adversely affecting the quality of the waters in this section of the St. Lawrence River.

Samples were collected from the waters of the principal tributaries of Lake Ontario and the St. Lawrence River along the front of Frontenac County, i.e., Collins Breek, Cataraqui Creek, the Cataraqui River and their associated tributaries.

Additional samples were collected within the City of Kingston at five(5) municipal combined sewer outlets, at four(4) municipal storm drain outlets, and at institutional, industrial, military and private outfalls which discharge to watercourses.

Within the Township of Kingston and the Township of Pittsburgh, samples were collected from outfalls which could affect the bacteriological and sanitary chemical qualities of the receiving waters.

Sampling Results

The laboratory results of samples collected from Lake Ontario and the St. Lawrence River opposite the Township of Kingston and the City of Kingston on June 10th and 11th, 1959, did not reveal any significant condition of sanitary

pollution(Table I). High bacteriological contents were revealed at sampling points, K.L.R., S, and V, in the main flow of the river along the front of Pittsburgh Township in the vicinity of the City of Kingston sewage treatment plant outfall. The B.O.D. figures for all samples were low. This survey did not extend into the beach waters of Pittsburgh Township. The locations of these sampling points may be observed on the appended map of "Lake Ontario and the St.Lawrence River along the front of Frontenac County".

Samples were collected from the waters of the St.Lawrence River in the vicinity of the City of Kingston sewage treatment plant, and including the beach waters, on August 26th, 1959, and revealed a high bacteriological content at sampling points, 10, 11, 12, 20, all located downstream from the sewage treatment plant outfall. The sample results are tabulated in Table II and reveal that the bacteriological intensities tended to be more pronounced on this date, near the shoreline at locations approximately one-half mile to one mile downstream from the sewage treatment plant. Again the B.O.D. results were quite low. The change in the locations of the higher bacteriological concentrations from those observed in the previous survey of June 10th, 1959, indicates the need for more intensive investigations to indicate the origin and travel of this bacteriological pollution. One factor not to be overlooked in such investigations would be the intensity and direction of wind forces. It is considered that these coliform

concentrations, if they come from sewage, although intermittent in nature can be lessened if effluent chlorination is practised at the City of Kingston sewage treatment plant during the summer months.

A sample was collected on August 26th, 1959, from the mouth of a small creek which flows into the St. Lawrence River at the Y.M.C.A Day Camp. A count of 21,000 coliform organisms per 100 millilitres, as determined by the Membrane Filter technique, was revealed in the limited flow from this stream to the St. Lawrence River.

Locations of sampling points employed on August 26th, 1959, are shown on a map of this specific area on page 77..

Table III shows the laboratory results of samples collected during the month of June 1959, from the principal tributaries of Lake Ontario and the St. Lawrence River along the front of Frontenac County, i.e., Collins Creek, Cataraqui Creek, the Cataraqui River, and their associated tributaries. The sample (#3087) which was collected from the south-western tributary of Cataraqui Creek at Day's Road, LaSalle Park, confirms the presence of household wastes which were visually evident on June 29th, 1959. The effects of industrial waste discharges from Brookside Farm Dairy are reflected in the sample (#3024) collected from Cataraqui Creek at Counter Street within the City of Kingston. Samples #R-205 and #2784 were collected from the Cataraqui River on May 28th and June 15th, respectively, and reveal the effects of industrial waste

discharges from the A. Davis and Son Limited, Tannery. An undesirable phenolic waste content is revealed in the waters of the Cataraqui River in this area.

Table IV indicates the bacteriological and sanitary chemical qualities of samples collected on June 11th, 1959, from five (5) municipal combined sewer outfalls within the City of Kingston where flows were discharging to Lake Ontario and in one case, to the Cataraqui River. The laboratory results reveal the excessive five-day B.O.D. and coliform contents in all of these flows, confirming the visual observation that untreated sanitary sewage was escaping to the waterfront during a period devoid of appreciable precipitation. Further reference is made to these sewer overflows in Chapter II of this report which deals with sewage works within the City of Kingston. A sample (#2779) was collected from a drain which was discharging to the Cataraqui River near Hickson Avenue. The presence of untreated or inadequately treated sanitary wastes was revealed in this discharge. It was reported, subsequently, however, that this condition had been corrected by the provision of municipal sanitary sewer services in this area.

Table V shows the laboratory results obtained from samples collected from municipal storm drainage discharges within the City of Kingston. Sanitary or domestic wastes are revealed in two (2) improved ditches discharging to the Cataraqui River. Of concern is the municipal storm drainage which was discharging to Lake Ontario through the improved

section of Portsmouth Creek near the foot of Yonge Street. Samples were collected from this discharge on June 15th and June 24th, 1959, and revealed the presence of untreated sanitary sewage. This condition reportedly resulted from a blocked sewer on Yonge Street, as a result of which, sanitary wastes were diverted to the storm drain.

In Table VI is shown the laboratory results obtained from samples which were collected on June 11th and 13th, 1959, either from direct discharges or in the vicinity of outfalls from branches of the Ontario Hospital, Kingston, to Lake Ontario. Inadequately treated sanitary wastes are revealed in samples collected from the lake in the vicinity of the western and central outfalls near the Rockwood branch, and in samples collected from the drain which serves mutually the Ontario Hospital Farm and the Cataraqui Golf and Country Club.

The laboratory results of samples collected from industrial premises within the City of Kingston are shown in Table VII. Inadequately treated industrial and, in some cases, sanitary wastes, are revealed in samples collected from outfalls to Lake Ontario from the Canadian Locomotive Company Limited, to Cataraqui Creek from Brookside Farm Dairy, and to the Cataraqui River from the A. Davis and Son Limited Tannery. A small local tributary of the Cataraqui River receives inadequately treated sanitary and industrial wastes from Frontenac Floor and Wall Tile Limited and Globelite Batteries Limited.

The laboratory results of samples collected in the vicinity of submerged outfalls from military premises within the City of Kingston are tabulated in Table VIII. The premises concerned are Area Headquarters at 440 King Street, Fort Frontenac, and the Sergeant's Mess building which is associated with Fort Frontenac. Of significance is the excessive coliform content revealed in a sample collected in the vicinity of the south-east outfall from Fort Frontenac to Kingston harbour.

The laboratory results of three(3) outfall samples which were collected within the Township of Kingston are shown in Table IX. Samples were collected from each of the two(2) outfalls from the Dupont Company of Canada(1956)Limited to Cataraqui Bay, and reveal the need for continued waste treatment by this firm. The effluent which is discharged from the Collins Bay Penitentiary sewage treatment plant to Cataraqui Creek, is shown to be inadequately treated, both with respect to five-day B.O.D. content and bacteriological quality.

Table X reveals the bacteriological and sanitary chemical qualities of samples collected from outfalls to watercourses within the Township of Pittsburgh. The laboratory results reveal the presence of untreated or inadequately treated sanitary wastes in drainage from the Cana Subdivision to the Cataraqui River, and from the Royal Military College to Kingston harbour.

Summary

A sampling programme was conducted on Lake Ontario and the St.Lawrence River along the front of Frontenac County on

June 10th and 11th, 1959. On August 26th, 1959, an additional sampling programme was conducted on the St. Lawrence River in the vicinity of the City of Kingston sewage treatment plant.

The laboratory results of samples collected from the waterway on June 10th and 11th, 1959, did not reveal any significant instances of sanitary pollution opposite the Township of Kingston and the City of Kingston, although there are numerous sewage outfalls to this section of Lake Ontario. High bacteriological contents were revealed in samples collected from the main flow of the St. Lawrence River in the vicinity of the City of Kingston sewage treatment plant outfall in the Township of Pittsburgh.

The laboratory results of samples collected from the waters of the St. Lawrence River on August 26th, 1959, in the vicinity of the City of Kingston sewage treatment plant outfall reveal that the bacteriological content in these waters tended to increase near the shoreline at locations approximately one-half mile to one mile downstream from the sewage treatment plant outfall. Winds were from the south-west during both periods of sampling.

A high coliform content was revealed in a sample collected from the mouth of a small creek which flows into the St. Lawrence River at the Y.M.C.A. Day Camp in Pittsburgh Township.

Within the Township of Kingston it is evident that untreated or inadequately treated sanitary and domestic wastes enter the south-western tributary of Cataraqui Creek at Day's Road, LaSalle Park. Sample results reveal the need for further

treatment of the effluent from the Collins Bay Penitentiary sewage treatment plant to Cataraqui Creek.

Untreated sanitary wastes were escaping through five (5) municipal combined sewer overflow outlets from the City of Kingston to the waterfront during a period devoid of appreciable precipitation. These outlets are located near the waterfront at Beverley Street, Gore Street, Johnston Street, Queen Street, and Charles Street. Untreated or inadequately treated sanitary wastes were discharging from a drain at the foot of Hickson Avenue to the Cataraqui River on June 15th, 1959. It was reported subsequently that this drain had been connected to the city sewer system.

Untreated or inadequately treated sanitary wastes were revealed in the discharges from three(3) storm drain outlets to watercourses within the City of Kingston, and are located as follows: where a ditch extends from the vicinity of Portsmouth Avenue and Glengary Road to Cataraqui Creek, where a ditch terminates at a tributary of Cataraqui Creek south of Bath Road, and where a municipal storm drain discharges to Lake Ontario through an improved section of Portsmouth Creek.

Within the City of Kingston, inadequately treated effluent is discharged from the Ontario Hospital sewage treatment plant and associated outfalls to Lake Ontario. A drain serves mutually the Ontario Hospital Farm residence and the Cataraqui Golf and Country Club, conducting inadequately treated sanitary sewage to Cataraqui Bay. Municipal sewer services reportedly will be provided soon for branches of the

Ontario Hospital, Kingston, which presently remain unserved.

The Kingston Penitentiary is served by the city sewer system but reportedly discharges kitchen wastes to the lake. Industrial wastes from canning operations at this penitentiary are discharged to a pit and may leach to the lake. Prison officials propose to review their drainage system to ensure the exclusion of their contaminated flows from the lake.

Inadequately treated or untreated sanitary wastes are discharged to the waterfront from numerous industrial and commercial premises within the City of Kingston. A list of the names of these firms is shown on page 28.

With respect to military premises, untreated sanitary sewage is discharged from Area Headquarters, Fort Frontenac, and the Sergeant's Mess which is associated with Fort Frontenac, to Lake Ontario or to Kingston harbour.

From a private residence located at 346 King Street, Kingston, partially treated sanitary wastes discharge to the lake.

Within the Township of Pittsburgh, inadequately treated sanitary sewage was draining to the Cataraqui River from the sewage disposal system which serves the Cana Subdivision. Untreated sanitary and domestic sewage is discharged from the Royal Military College to Kingston harbour. A private sewage pumping station presently is being constructed on the Royal Military College premises to permit the Royal Military College as well as H.M.C.S. Cataraqui to discharge sewage over the height of land at Barriefield to the City of Kingston sewage treatment plant.

A high coliform content was revealed in a sample collected from a small creek which flows into the St. Lawrence River at the Y.M.C.A. Day Camp.

Recommendations

City of Kingston-

1. The City of Kingston should proceed on an increased programme of storm sewer installation which not only will reduce the volume of flow presently requiring treatment at the municipal sewage treatment plant, but also will assist in reducing public health objections which result when increased flows in the combined sewer system overflow to the watercourses.
2. Additional consideration should be given to the installation of facilities at the sewage treatment plant to provide chlorination of the effluent during the summer months. The need for effluent chlorination is revealed by the intermittent presence of a high bacteriological content in the river downstream from the Kingston sewage treatment plant. Further water sampling surveys on this should be carried out.
3. Action is necessary within the City of Kingston to ensure the exclusion of contaminated flows from three(3) municipal storm drainage outlets to watercourses.
4. Prompt completion of municipal sewer connections at the Ontario Hospital, Kingston, is necessary to exclude these inadequately treated sanitary waste discharges from Lake Ontario.
5. The Cataraqui Golf and Country Club should revise their waste disposal procedures to exclude their inadequately

treated sanitary and domestic wastes from the drain which terminates at Cataraqui Bay.

6. Kingston Penitentiary officials should review their drainage systems and ensure that only uncontaminated flows are permitted to discharge from these premises to Lake Ontario.

7. With respect to military premises, Fort Frontenac and its associated buildings should be connected to the municipal sewer system at an early date since facilities already are available. The provision of facilities for serving Area Headquarters and adjacent private residences near the lakeshore should be given early consideration.

8. Local municipal officials should continue with their programme of providing sewer services for the numerous industrial and commercial premises located near the waterways which presently discharge untreated or inadequately treated sewage either directly to the watercourses or indirectly through municipal drain outlets.

Township of Kingston-

1. The problems revealed at LaSalle Park with respect to sewage disposal on individual premises indicate the need for an overall sewage works programme.

2. Dupont Company of Canada(1956)Limited should continue with their programme of improved treatment for their sanitary and industrial wastes which presently discharge to Cataraqui Bay.

3. Early action is necessary at Collins Bay Penitentiary to provide adequate treatment for the sewage flows

which are discharged from this institution to Cataraqui Creek.

Consideration should be given to:

- (a) Discharging sewage from Collins Bay Penitentiary to the City of Kingston municipal sewer system; or
- (b) Providing a private plant of adequate capacity for complete treatment of the sewage; or
- (c) Consulting with Kingston Township officials and participating in their sewage works programme if a positive development is imminent.

4. Immediate action should be taken to provide effective chlorination of the effluent which discharges from this institution to Cataraqui Creek.

Township of Pittsburgh-

1. As recommended by Mr. Garnet Kay, District Engineer with this Commission, following an inspection of the sewage disposal system at the Cana Subdivision on June 9th and 10th, 1959, frequent supervision and adequate maintenance of this community sewage disposal system is necessary to prevent inadequately treated sewage effluent from discharging to the Cataraqui River.
2. Early completion of the sewage pumping station at the Royal Military College is necessary to permit sewage flows from these premises to be discharged to the City of Kingston sewer system rather than to Kingston harbour without prior treatment. This sewage pumping station reportedly will serve H.M.C.S. Cataraqui as well.
3. The local Medical Officer of Health should ensure that the small creek which flows into the St. Lawrence River at

the Y.M.C.A. Day Camp does not receive untreated or inadequately treated sanitary wastes.

Chapter II

FRONTENAC COUNTY

City of Kingston

General

The City of Kingston is located in Frontenac County on the north shore of Lake Ontario where it narrows to form the St. Lawrence River. The municipality, with an approximate population of 51,000, covers a water and land area of 15,690.8 acres which may be broken down to 7581.5 acres and 8109.3 acres, respectively.

Geography and Geology

The City is drained either directly to Lake Ontario or to tributaries of that waterway. The two(2) principal drainage courses concerned are Cataraqui Creek and the Cataraqui River.

Cataraqui Creek drains the western and north-western sections of the municipality, flowing in a bed bordered by marshlands to Lake Ontario. The stream flow in Cataraqui Creek becomes minimal with negligible advance during summer months.

The Cataraqui River constitutes in part, the Rideau Canal System, as it flows to its junction with Lake Ontario, and forms the eastern boundary of the City of Kingston. The lake appears to terminate at the mouth of the Cataraqui River and narrows as it becomes the St. Lawrence River.

Cataraqui Creek and the Cataraqui River flow very slowly near their mouths as the levels of their waters approach the level of the lake.

Within the City is found fissured limestone bedrock which is characteristic of this section of Frontenac County. The clay overburden varies in depth from only a few inches to several feet. The need for municipal sewer and water services is even more obvious where such geological conditions prevail. Increased costs of installing water mains and sewers under these conditions are apparent.

Historical Note

Originally an Indian council site, Kingston became important as a military stronghold and a seat of government.

Kingston's location at the mouth of the Cataraqui River (later part of the Rideau Canal System) made it a strategic military site. Occupied by French forces from 1673 until its possession was gained by the British in 1758, Fort Frontenac was of military importance.

In 1792 the first executive council of Upper Canada met at Kingston, followed in 1841-44 by the assembly for the United Provinces of Canada.

Economic Growth

Kingston has developed as an educational, industrial, and military centre. Queen's University and Regiopolis College are located here.

Industrial activity in and near Kingston has increased markedly since the termination of World War II. The associated increase in residential development has resulted in a demand for expansion of services.

Kingston has long been a military centre. The National Defence College and the Canadian Army Staff College are established permanently at Fort Frontenac.

Federal penal institutions are established here. Custodial facilities for males and females are located at Kingston Penitentiary in the western part of the municipality. Across Cataraqui Creek in Kingston Township is Collins Bay Penitentiary.

An Ontario Hospital with its associated branches is located near the lakeshore in the western part of the city.

Transportation

The shipping facilities of the Great Lakes waterway has been a contributing factor in the growth of Kingston. The city is served also by main routes of the Canadian Pacific and Canadian National Railways, as well as Highways #2, 15, 33, 38 and 401.

Health Services

A public health organization is of inestimable value to a municipality which is experiencing rapid growth. The City of Kingston Health Department under the direction of Dr. R.A. Kelly, Medical Officer of Health, performs among others, an important role with respect to the supervision of the installation of private sewage disposal systems where municipal sanitary sewer services are not available.

Recreational Sites

Due to its location on the shore of Lake Ontario,

Kingston would appear to be well endowed with natural swimming sites. Two favoured swimming areas have been Lake Ontario Park near the western limits of the city, and Macdonald Park which is centrally located. Swimming in the lake off Macdonald Park has been limited recently due to the proximity of municipal combined sewer outlets where overflows frequently occur. The high coliform content in discharges from the Ontario Hospital premises upstream from Macdonald Park has been of additional significance.

Artificial swimming pools are employed seasonally in the City parks. Disinfection procedures which are employed at these pools are supervised by members of the local Health Department staff,

Water Supply

The City of Kingston municipal water supply is drawn from Lake Ontario. At Lake Ontario Park and at Kingston Penitentiary, lake water is drawn and chlorinated for domestic purposes.

The Kingston Grain Elevator and the Cataraqui Golf and Country Club employ lake water for purposes other than domestic use.

The A.Davis and Son Limited Tannery draws water from the Cataraqui River for industrial use.

Municipal Water Works

The city water supply is drawn from Lake Ontario through a single intake pipe extending 1200 feet into the lake.

Water enters the low lift suction well by gravity and is delivered by low lift pumps to the mixing and settling basins. Alum is employed for flocculation purposes. The water proceeds by gravity to the rapid sand filters and thence to the clear water reservoir. High lift pumps deliver the water to the distribution system and the elevated tank. Pre-chlorination and post-chlorination treatments are employed. Although tastes of a phenolic nature occasionally occur in the water supply, equipment for combatting chloro-phenolic tastes has not been installed.

The treatment capacity of the water works plant is rated at 10 million gallons per day. An average daily water demand of 8.0 to 9.0 million gallons is reported, varying with seasonal requirements. The city water works system, as well as servicing most of the municipality, also serves the Royal Military College, Old Fort Henry, and the military establishment at Barriefield, all in Pittsburgh Township.

Kingston's water works system is operated by the local Public Utilities Commission.

Sewage Works

Prior to the completion of Kingston's recent sewerage programme the city was served by a system of combined sewers, the flows from which discharged through twenty-four(24) outlets to Lake Ontario, the Cataraqui River, and Cataraqui Creek. The existing sewage system became operative in 1958.

Kingston's sewage treatment plant is located near

the banks of the St. Lawrence River in Pittsburgh Township, approximately three(3) miles east of the city. An interceptor sewer extending along the lake and harbour fronts, as well as a trunk sewer circling through the western and northern parts of the municipality, delivers sanitary sewage, storm water, and some industrial wastes to the main sewage pumping station at River Street. From the River Street sewage pumping station on the west bank of the Cataraqui River, sewage is pumped over the height of land at Barriefield to flow by gravity to the treatment plant. The National Defence premises in Pittsburgh Township are served by the city sewer system. A portion of this military area in the township employs a private sewage pumping station to deliver sewage into the trunk sewer.

The locations of the four(4) municipal sewage pumping stations, as well as the main pumping station at River Street, are shown on the appended map of the City of Kingston. The following is a brief description of the locations and emergency overflow arrangements at these sewage pumping stations:

1. River Street pumping station
 - located on west bank of Cataraqui River
 - emergency overflow to Cataraqui River
2. O'Kill Street pumping station
 - located on O'Kill Street at the lakeshore
 - emergency overflow arrangement to Lake Ontario
3. Portsmouth pumping station
 - located on King Street West
 - emergency overflow arrangement to Lake Ontario

4. Palace Road pumping station
 - located on west side of Palace Road near Brock Street
 - emergency overflow arrangement to a drain terminating at Portsmouth Creek near the lake
5. North-end pumping station
 - located near Highway #401
 - overflow arrangement proposed to Cataraqui Creek

The Palace Road sewage pumping station experienced a serious overflow to a nearby field during 1955 due to the failure of pumping equipment.

While not provided with a formal overflow arrangement, heavy loading at the North-end pumping station reportedly has been relieved by discharging a portion of the sewage flow to Cataraqui Creek which flows nearby. The construction of an emergency overflow arrangement at this pumping station has been proposed and would permit the discharge of sewage to Cataraqui Creek. The force main design here made allowance for future increased force main installations. If a parallel force main were installed now, the frequency of overflow would be diminished. A further improvement at this station would be the installation of pumping units of greater capacity. It is imperative that any overflow from this sewage pumping station to Cataraqui Creek should be installed judiciously, since the mouth of this creek is located upstream from all water works intakes within the City of Kingston.

The operational procedure at the River Street pumping station reportedly consists of full-rate pumping for approximately the first 30 minutes of full flow, followed by a

reduction to a pumping rate of 8,000,000 gallons per day, with flows in excess of this rate being permitted to overflow to the Cataraqui River. These overflows do not receive the benefit of comminution and dilution effects that would be accorded them were they pumped to the sewage treatment plant and discharged to the St. Lawrence River.

The private sewage pumping station on the east bank of the Cataraqui River which serves part of the military area in Pittsburgh Township reportedly has an emergency overflow arrangement to the Cataraqui River.

An additional municipal sewage pumping station has been proposed to serve Area Headquarters and adjacent premises near the lakeshore. This pumping station reportedly will be located at the foot of Morton Street and will be provided with an emergency overflow either to the municipal storm drain on Morton Street or directly to Lake Ontario.

The Department of National Defence presently is constructing a sewage pumping station on the Royal Military College premises in Pittsburgh Township, to serve the Military College, H.M.C.S. Cataraqui, and an adjacent recreation building. Sewage will be pumped over the height of land at Barriefield to flow by gravity to Kingston's sewage treatment plant. A relief overflow from the Royal Military College sewer system will permit the emergency discharge of sewage from these premises to the mouth of the Cataraqui River.

The interceptor sewer extending along Kingston's

waterfront receives the sanitary and storm flows which previously discharged directly to the waterways. The old outlets are employed in many instances to provide overflows from the sewer system during periods of increased flow.

Samples were collected on June 11th, 1959, from discharges which were observed at five(5) overflow outlets from the sewer system to Lake Ontario and the Cataraqui River. These discharges were located at outlets from Beverley Street, Gore Street, Johnston Street, Queen Street, and Charles Street. At Brock Street the interceptor sewer was on the verge of overflowing. The laboratory results of analyses which were conducted on these samples are tabulated in Table III and reveal the presence of untreated sanitary sewage in these effluents, as was visually observed at the time of sampling. The overflow of sewage at these locations on June 11th, 1959, following a period devoid of notable precipitation, could be attributed in part to blockage by rags, and in some cases to faulty benching. Infiltration is considered to be a contributing factor in the intermittent surcharging of the sewer system.

The City of Kingston sewage treatment plant is a primary type treatment with a design capacity of 9.0 million Imperial gallons per day. The present indicated dry weather flow to the plant approximates 7.5 million gallons per day. The plant frequently becomes hydraulically overloaded, due in part to the combined nature of the sewer system, to infiltration, illegal house drainage connections and increased

land development. The effluent from the sewage treatment plant discharges to the St. Lawrence River through a 600-foot 42-inch diameter outfall sewer which terminates in approximately 42 feet of water.

For a more detailed description of the Kingston sewage treatment plant, reference should be made to the recent report on this plant by Mr. Garnet Kay, District Engineer, Ontario Water Resources Commission.

Although most of the City of Kingston is serviced by the municipal sanitary and combined sewer systems, large areas of land remain undeveloped in the western and northern sections of the municipality. Fort Frontenac, Area Headquarters, Ontario Hospital (except for Mowat Division) and many commercial and industrial premises, as well as several private residences along the waterfront, remain unserved by the municipal sewer system. In addition, the Royal Military College and H.M.C.S. Cataraqui in Pittsburgh Township eventually will be serviced by the city sanitary sewer system.

A small watercourse which discharges to the Cataraqui River at Montreal Street near McKenna Avenue conducts sanitary wastes as well as some industrial wastes, as is revealed by the laboratory results of samples collected. The local Health Department staff recently has been investigating the sources of illegal private discharges of untreated or inadequately treated sanitary waste to this watercourse.

Storm Drainage

Networks of storm drains serve the City of Kingston

and have their outfalls to Cataraqui Creek, Lake Ontario, or the Cataraqui River. Flows were observed and sampled at the outlets from two(2) municipal storm drains and two(2) improved ditches during this survey. These sampling points and the pertinent laboratory results are tabulated in Table V. The sampling locations are:

1. Where a ditch from the vicinity of Portsmouth Avenue and Glengary Road terminates on the east bank of Cataraqui Creek.
2. Where a ditch on the south side of Bath Road discharges to a tributary of Cataraqui Creek.
3. Where a municipal storm drain discharges through an improved section of Portsmouth Creek to Lake Ontario near the foot of Yonge Street.
4. Where a storm drain flows to Lake Ontario from Morton Street.

The laboratory results reveal the presence of coliform organisms suggesting sanitary or domestic wastes in the samples collected at each of the first three locations. The presence of sanitary wastes in the improved portion of Portsmouth Creek reportedly resulted from a blocked sewer on Yonge Street.

Industrial and Commercial Outfalls

Investigations were made to determine the methods of waste disposal which are employed by industrial and commercial firms along the waterfront of the City of Kingston. The following is a list of firms which were visited during this survey, and were found to be discharging untreated or inadequately treated sanitary wastes, and in some cases industrial wastes, either directly or indirectly to natural watercourses:

Brookside Farm Dairy
Kingston Grain Elevator
Pyke Salvage and Navigation Company Limited
Frost the Mover
Canadian Locomotive Company Limited
Kingston Shipyards
Topnotch Feeds Limited and R.C.A.F.Club
Kingston Excursions Limited
Crawford Coal and Fuel Company
Canada Steamship Lines Limited
Millard and Lumb Limited
Canadian Dredge and Dock Company Limited
Tepson's Limited
Bunkhouse at C.P.R.Roundhouse
C.Lloyd and Sons Limited
Shell Oil Company of Canada Limited
Hield Brothers(Canada)Limited
A.Davis and Son Limited, Tannery
Globelite Batteries Limited
Frontenac Floor and Wall Tile Limited

Samples were collected, where possible, from industrial and commercial outfalls. The laboratory results have been tabulated in Table VII. Individual reports on these firms, with pertinent recommendations, have been prepared for distribution to the appropriate persons.

Brookside Farm Dairy, Counter Street-

Untreated industrial wastes are discharged from this plant to Cataraqui Creek. The following laboratory results reveal the characteristics of this waste:

<u>Date of Sample</u>	<u>5 Day B.O.D.</u>	<u>Solids(p.p.m.)</u>			<u>Total Coliform Count per 100 ml.(Ind.No.)</u>
		<u>Total</u>	<u>Susp.</u>	<u>Diss.</u>	
June 15	73	870	68	802	100,000

Kingston Grain Elevator, King Street West-

Untreated sanitary wastes reportedly are discharged from these premises through submerged outfalls to Lake Ontario upstream from all water works intakes within the city.

Pyke Salvage and Navigation Company Limited- foot
of Gore Street-

Sanitary wastes are discharged without prior treatment from this property to the lake.

Frost the Mover- 37 Gore Street-

This local representative of North American Van Lines reportedly discharges sanitary wastes to the Gore Street municipal storm drain which terminates at the lakeshore.

Canadian Locomotive Company Limited, 140 Ontario St. -

Untreated sanitary wastes are discharged from this plant to Lake Ontario. A high bacteriological content was revealed by the results of samples which were collected from, or in the vicinity of outfalls from the Canadian Locomotive Company Limited to the lake. A portion of the sanitary wastes from this plant reportedly is discharged to the William Street municipal storm drain which terminates on the lakeshore.

Investigations of the waste disposal methods which are employed by the Canadian Locomotive Company Limited have been made recently by members of the Industrial Wastes Section of this Commission.

Kingston Shipyards, Ontario Street-

A visit to Kingston Shipyards on February 5th, 1959, revealed that sanitary wastes are discharged from a washroom in the power-house to the lake. Other sanitary wastes are discharged from these premises to the municipal sewer system. Information received during the month of June 1959, indicated

that the use of the washroom in the power-house had been discontinued.

Topnotch Feeds Limited, R.C.A.F. Club, Kingston
Excursions Limited and Crawford Coal and Fuel
Company, all in the vicinity of the foot of
Princess Street-

The above concerns are located on property owned by James Richardson and Sons Limited, 253 Ontario Street, Kingston. All sanitary wastes reportedly are discharged without prior treatment to Lake Ontario. City planning may include the provision of municipal sewer services for these premises.

Canada Steamship Lines, foot of Queen Street-

Although this firm reportedly has discharged sanitary wastes to the lake, a company official reported on June 29th, 1959, that occupancy of the premises was being discontinued as of June 30th, 1959.

Millard and Lumb Limited, King Street East-

The sanitary wastes from this metal boiler repair plant reportedly are discharged without prior treatment to a municipal storm drain which extends past these premises and terminates on the banks of the Cataraqui River. The municipal harbour front interceptor sanitary sewer extends along Place D'Armes past these premises.

Canadian Dredge and Dock Company Ltd., foot of North St.

Untreated sanitary wastes are discharged from these premises through two(2) submerged outlets to the Cataraqui River. The harbour front interceptor sewer appears to be accessible to this firm, although at this point is located beyond a C.P.R. right-of-way and a C.N.R. right-of-way.

Tepson's Limited, foot of North Street-

This firm is a wholesale distributor of plywood. Sanitary wastes reportedly are discharged to the municipal storm drain which has a submerged outlet to the Cataraqui River at the foot of North Street.

Bunkhouse at C.F.R.Roundhouse, foot of North Street-

A crew of five(5) men normally occupies these quarters. A bathroom group and a kitchen sink in this building reportedly discharge to the North Street municipal storm drain which has its outlet to the Cataraqui River.

Shell Oil Company of Canada Limited, foot of North Street-

C.Lloyd and Sons Limited, foot of North Street-

A Shell Oil Company of Canada Limited maintenance building as well as the C.Lloyd and Sons Limited sash and door plant are located on property owned by the former company. Sanitary wastes from both premises reportedly are discharged through the North Street municipal storm drain submerged outfall to the Cataraqui River.

Hield Brothers(Canada)Limited, Cataraqui Street-

Yarn and cloth are manufactured by this firm. Approximately one-third of the sanitary wastes from this plant are discharged to the municipal sewer system, the remaining two-thirds being discharged through a private drain to the Cataraqui River. A discussion on June 26th, 1959, with the plant manager revealed that engineering advice had been obtained with respect to alternations of the building drains, and all

wastes will soon be discharging by gravity to the municipal harbour front interceptor sewer.

A.Davis and Son Limited, Tannery, 407 Rideau Street-

Sanitary and industrial wastes from this tannery are discharged to a small local tributary of the Cataraqui River. Samples pertinent to the tannery wastes discharges have been collected by members of the Sanitary Engineering Division and the Industrial Wastes Section of this Commission, and the results of analyses thereon reveal a high five-day B.O.D., bacteriological, chromium and phenol content in these flows.

Globelite Batteries Limited-

This manufacturer of batteries is located in north-eastern Kingston. Untreated sanitary wastes and presumably some industrial wastes are discharged through a private drain which is employed also by Frontenac Floor and Wall Tile Limited, to a small local tributary of the Cataraqui River. The following sample results indicate the quality of the flows from Globelite Batteries Limited:

<u>Location of Sample</u>	<u>Date of Sample</u> 1959	<u>5 Day B.O.D.</u> p.p.m.	<u>Solids(p.p.m.)</u> <u>Total Susp.Diss.</u>	<u>Total Coliform</u> <u>Count per 100 ml.</u> Ind.No.
Manhole at Globelite Batteries Ltd.	June 29	15	458 52 406	0

pH at lab.- 5.2
Acidity - 3.5 p.p.m.
Lead as Pb- 2.8 p.p.m.

The absence of a bacteriological content might be attributed to the acidity of these flows.

Frontenac Floor and Wall Tile Limited-

The plant is located in proximity to Globelite Batteries Limited. The drain employed mutually by these two (2) firms terminates on the banks of a small local tributary of the Cataraqui River. The following laboratory results of samples collected on June 25th, 1959, show a comparison of the qualities of these flows, as well as their combined quality:

<u>Location of Samples</u>	<u>5 Day B.O.D. p.p.m.</u>	<u>Solids(p.p.m.) Total Susp. Diss.</u>			<u>pH at lab.</u>	<u>Total coliformm Count per 100 ml. Ind. No.</u>
Manhole sample Globelite Batteries Ltd.	15	458	52	406	5.2	0
Acidity p.p.m.- Lead as pb. -	35 2.8					
Combined effl. Acidity p.p.m.- Lead as pb.-	27 -- 4.5	1028	706	322	7.9	1000

The above industrial and commercial concerns have been requested to revise their methods of sewage disposal in order to exclude untreated or inadequately treated wastes from natural watercourses. Securing of municipal services, where possible, has been suggested as the preferable solution.

Institutional Outfalls

Institutions located within the City of Kingston and which were found to be of importance in preparing this report are the Ontario Hospital and the Kingston Penitentiary.

Ontario Hospital

The Ontario Hospital, Kingston, is composed of

four (4) main units: the original Rockwood Building, the new hospital, the Mowat Division and the Newcourt Division.

A private sewage treatment plant receives the sanitary and domestic wastes from the two(2) main hospital buildings. This private sewage treatment plant has its outfall to Lake Ontario upstream from the city's municipal water works intake.

The Mowat Division on Portsmouth Avenue is serviced by the municipal sewer system.

The Newcourt Division, or hospital farm, is served by a septic tank. Dye tests were conducted on June 23, 1959, and confirmed the fact that the effluent from this septic tank discharges through a drain to Lake Ontario near Richardson's Dock. Dye testing revealed that this drain also conducts untreated or partially treated sanitary wastes from the Cataraqui Golf and Country Club.

The Ontario Hospital sewage treatment plant is located east of the Rockwood building and near the lakeshore. Treatment facilities consist of an Imhoff tank, a trickling filter, and a humus tank. Disinfection of the effluent is provided by permitting a solution of chloride of lime to trickle into the partially treated flows. The final effluent is discharged to Lake Ontario. Sewage flows to the treatment plant may be bypassed through a separate outfall to the lake.

Since the capacity of this sewage treatment plant has not been increased to keep pace with the growth of the institution, it is greatly overloaded.

Following negotiations with the City of Kingston, an agreement has been reached whereby a municipal sewer connection or connections will be provided for those branches of the Ontario Hospital which are presently unserved, namely the two (2) main hospital buildings and the Newcourt Division. These services reportedly will be provided in the near future.

The laboratory results of "grab" samples which were collected at locations pertinent to the Ontario Hospital are shown in Table V, and reveal the necessity either for excluding these wastes from the lake or for providing further treatment for these flows.

Kingston Penitentiary

This institution is served by separate systems of sanitary and storm sewers. Sanitary wastes from the quarters for males and females at the penitentiary are collected and pumped to the city sewer system. Kitchen wastes are discharged to the storm drain system which has its outfall in Lake Ontario.

At the request of penitentiary officials, a visit was made to Kingston Penitentiary by Mr. Garnet Kay of this Commission on August 20, 1959, to discuss a proposed revision and expansion of canning factory operations at the prison. Mr. Kay has recommended that only uncontaminated flows be discharged to the lake, and that kitchen wastes and any other contaminated flows should be discharged to the city sewer system.

Recreational Premises

The Cataraqui Golf and Country Club is located immediately west of the Ontario Hospital Farm (Newcourt Division).

Sanitary wastes reportedly are discharged to a septic tank and tile bed system. However, dye testing revealed on June 23, 1959, that sanitary wastes from the Golf Club and the Ontario Hospital Farm flow through a common drain to Cataraqui Bay. The laboratory results of samples collected from this discharge on June 13, 1959, are shown in Table VI and reveal the presence of inadequately treated sanitary wastes.

Military Establishment

Within the City of Kingston, the following National Defence premises discharge sanitary wastes either to Lake Ontario or to Kingston harbour:

Area Headquarters- 540 King Street West

Fort Frontenac(National Defence College and Canadian Army Staff College)south side of Ontario St.

Fort Frontenac (Sergeants' Mess)north side of Ontario Street

Area Headquarters

Approximately five(5)submerged outfalls from Area Headquarters to Lake Ontario were observed on June 15, 1959. Although it was not determined whether all these outfalls are employed in the disposal of sanitary wastes, three(3) grab samples were collected in the vicinity of these outfalls. The following results are reported from the analyses of these

samples:

Location of Sample	Date of Sample 1959	5 Day B.O.D. p.p.m.	Solids Total p.p.m.	Turbidity Silica Units p.p.m.	Total Coliform Count per 100 ml. Ind.No.
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Ten feet offshore

W.side Area

Headquarters June 15 1.4 222 2 100

<u>Location of Sample</u>	<u>Date of Sample</u>	<u>5 Day B.O.D. p.p.m.</u>	<u>Solids Total p.p.m.</u>	<u>Turbidity Silica units p.p.m.</u>	<u>Total Coliform Count per 100 ml. Ind. No.</u>
Vicinity of outfall from A.H.Q.	June 15	1.4	182	1	100
Vicinity of East outfall	" "	1.3	184	2.0	10

Although "grab" samples collected in the vicinity of the outfalls from Area Headquarters do not reveal a high content of sanitary wastes at this time, it was established from information received that sewage flows from this military administration establishment are discharged to the lake.

The construction of a municipal sewage pumping station near the foot of Morton Street as proposed will enable Area Headquarters as well as adjacent residences near the lakeshore to obtain municipal sewer services.

Fort Frontenac(National Defence College and Canadian Army Staff College)

Located on the south side of Ontario Street near the LaSalle Causeway, Fort Frontenac houses the National Defence College and the Canadian Army Staff College. Although municipal sewer facilities have been made available to Fort Frontenac on Ontario Street, a connection thereto had not been made as of June 15, 1959. Sanitary and domestic wastes continued to discharge through two(2) known submerged outfalls to Kingston harbour. The laboratory results of "grab" samples which were collected in the vicinity of these outfalls on June 15, 1959, are reported as follows:

<u>Location of Sample</u>	<u>5 Day B.O.D. p.p.m.</u>	<u>Total Solids p.p.m.</u>	<u>Turbidity Silica Units(p.p.m.)</u>	<u>Total Coliform Count per 100 ml.(Ind.No.</u>
Vicinity of Last outfall from Fort Frontenac	1.3	178	4	1,000
Vicinity of South-East outfall from Fort Frontenac	2.0	242	4	10,000,000+

The above results reveal the presence of untreated or inadequately treated sanitary wastes in the discharges from Fort Frontenac to the watercourse. A clouding effect was observed in the water near the south-east outfall at the time of sampling.

According to information received, pumping equipment will be employed in part, to deliver sewage from Fort Frontenac to the Ontario Street municipal sewer.

Fort Frontenac(Sergeants' Mess)

The quarters occupied by the Sergeants' Mess are located on the north side of Ontario Street, opposite Fort Frontenac. Untreated sanitary and domestic wastes are discharged from these premises through a private drain to Kingston harbour. Samples were collected on June 15, 1959, in the vicinity of the submerged outfall. The laboratory results are reported as follows:

<u>5 Day B.O.D. p.p.m.</u>	<u>Total Solids p.p.m.</u>	<u>Turbidity in Silica Units p.p.m.</u>	<u>Total Coliform Count per 100 ml. Ind.No.</u>
1.3	182	5	100

These results do not reveal a high content of sanitary wastes at this time, which may be attributed to the

intermittent nature of this direct discharge.

The provision of municipal sewer services for the Sergeants' Mess building as well as for premises within the Fort itself should be given early consideration.

Private Residential Outfalls

The residence of Mr. W. P. Holdcroft, 346 King Street West, is served by a septic tank with the effluent discharging through a submerged outlet to the lake. This residence presumably will be served by the municipal sewer system when the proposed Morton Street sewage pumping station will have become operative.

Summary

The City of Kingston is served by a system of sanitary, storm, and combined sewers. Five(5) sewage pumping stations are employed to deliver these combined flows to the city's sewage treatment plant located east of the army camp in Pittsburgh Township. An additional sewage pumping station has been proposed to serve a section of the city lying near the lakeshore in the vicinity of Morton Street. Approximately sixteen(16) outlets from the sewer system can permit sewage to overflow to Lake Ontario and the Cataraqui River. Overflows were evident at five(5) of these outlets on June 10th and 11th, 1959, during a period devoid of notable precipitation. The laboratory results of samples collected reveal the presence of untreated sanitary sewage. Infiltration of ground water into the sewers further aggravates this condition by increasing the

rate of overflow.

Some high coliform counts have been revealed in samples collected from the waters of the St. Lawrence River in the vicinity of the Kingston sewage treatment plant outfall.

Most of the sewage pumping stations have associated overflows. These may contribute intermittent contaminated flows. The North-end pumping station is to be provided with an overflow to Cataraqui Creek. Since the mouth of this creek is located above all water works intakes within the City of Kingston, it is imperative that this outfall be installed judiciously. Also, the frequency of overflow could be minimized by increased force main and pumping installations at this pumping station.

The operational procedure at the River Street pumping station is reported to consist of full-rate pumping for approximately the first 30-minutes of full flow, followed by a reduction to a pumping rate of 8,000,000 gallons per day, with flows in excess of this rate being permitted to overflow to the Cataraqui River. These overflows are not accorded the comminution and dilution effects that would be accorded them were they pumped to the sewage treatment plant and discharged to the St. Lawrence River.

Sampling results reveal the presence of untreated or inadequately treated sanitary wastes in municipal storm drainage flows to watercourses at three(3) locations, which are as follows:

1. ditch from vicinity of Portsmouth Avenue and Glengary Road to the east bank of Cataraqui Creek;
2. ditch on the south side of Bath Road discharging to a tributary of Cataraqui Creek;
3. Municipal storm drain discharging through an improved section of Portsmouth Creek to Lake Ontario near the foot of Yonge Street.

As of June 1959, the Ontario Hospital(except for the Mowat Division), Fort Frontenac and Area Headquarters remained unserved by the city sewer system and, therefore, continued to discharge untreated or inadequately treated sanitary wastes to the lake. Connections to the city sewer system will be provided at an early date for those branches of the Ontario Hospital, Kingston, which presently remain unserved. The municipal sewer on Ontario Street had been extended to Fort Frontenac, but a connection thereto had not been made. The construction of a proposed sewage pumping station at the foot of Morton Street would permit the servicing of Area Headquarters.

Approximately twenty(20) industrial and commercial premises located on or near Kingston's waterfront were visited and found to be discharging untreated or inadequately treated sanitary wastes either directly to watercourses or indirectly through municipal storm drains which have their outfalls to watercourses.

The Kingston Penitentiary is served by the city sewer system. During a visit to this institution by Commission staff during this survey, it was revealed, however, that kitchen wastes were discharged through the prison's storm drain system to Lake Ontario.

One(1) private residential discharge of partially treated sanitary wastes to Lake Ontario was revealed during this survey. The proposed sewage pumping station on Morton Street reportedly will permit this residence to be provided with municipal sewer services.

Recommendations

Consideration should be given to the provision of increased force main facilities and pumping capacity at the North-end sewage pumping station. Any overflow installed at this station should be judiciously designed. The continued inspection and maintenance of all the overflows from the interceptor sewers is required.

Effluent chlorination should be practised at the Kingston sewage treatment plant during the summer months.

The City of Kingston should give consideration to an increased programme of storm sewer installation, which not only would reduce the volume of flow presently requiring treatment at the municipal sewage treatment plant, but also would assist in reducing the public health hazard which results when increased flows in the combined sewer system overflow to the watercourses.

The municipality should ensure the exclusion of untreated or inadequately treated sanitary wastes from two(2) improved ditches and one(1) municipal storm drain which have their outfalls to watercourses.

The provision of municipal sewer services for those branches of the Ontario Hospital, Kingston, which, presently

remain unserved, should be completed as soon as possible to eliminate the discharge of inadequately treated sanitary sewage from these premises to Lake Ontario.

Necessary action should be taken to provide municipal sewer services for Area Headquarters and Fort Frontenac. Similar action should be planned to serve the commercial, industrial and private premises located within the City of Kingston, which presently discharge untreated or inadequately treated sanitary wastes and, in some instances, industrial wastes to watercourses.

Kingston Penitentiary officials should review their drainage facilities and ensure that only uncontaminated wastes are permitted to discharge to Lake Ontario from these premises.

Chapter III
FRONTENAC COUNTY

Township of Kingston

General

The Township of Kingston occupies the south-western portion of Frontenac County, fronting on Lake Ontario. In its southern regions which are of interest in this survey, the township is bordered on the west by the Township of Ernestown in the County of Lennox and Addington, and on the east by the Township of Pittsburgh and the City of Kingston. The municipality has an assessed area of 44,282 acres, with an approximate population of 8,000 persons.

Geography and Geology

The natural drainage of the Township of Kingston is to Odessa Lake which is drained by Millhaven Creek to Lake Ontario; to Collins Creek and Cataraqui Creek which flow to Lake Ontario. Other areas drain directly to the lake, or to smaller watercourses which terminate at the lakeshore. The western bank of Cataraqui Creek forms, in part, the boundary between the Township of Kingston and the City of Kingston.

The Grenville limestone formation in this area is thinly covered by heavy clay soil of an impervious nature. Although the depth of the soil varies, it is evident that unfavourable conditions exist for the satisfactory operation of septic tank systems.

Economic Growth

Residential development has taken place at an

accelerated rate during recent years in the Township of Kingston, especially near the lakeshore. This increase is related, for the most part, to the rapid industrial growth of the area.

The Dupont Company of Canada(1956)Limited plant at Carruthers Point is one of the major industrial firms in Kingston Township.

Recreational Sites

Popular swimming areas are located along the lakeshore in the Reddendale area and on the Dupont Company property.

Water Supplies

Two(2) municipal water works draw water from Lake Ontario within Kingston Township. These are located at Queen's Acres subdivision and at the Point Pleasant subdivision. The Point Pleasant water distribution system, as well as supplying that subdivision, also serves LaSalle Park, Reddendale, and residential developments along Highway #33, the Airport Road and Lakeland Point.

The Queen's Acres water works system supplies the Queen's Acres subdivision, Elmwood subdivision, and the Maple Ridge development.

Both of these water works systems were built to serve V.L.A. subdivisions and subsequently have been taken over and expanded by the municipality.

A private water works system is employed at Westbrook where water is obtained from ground water sources.

Sewage Disposal

The residential areas in Kingston Township are .

served by private septic tank systems. New installations are supervised by Mr. Thomas Burtch, Collins Bay, Township Building Inspector. The shallow overburden of heavy clay on the fissured limestone formation in this region tends to impair the functioning of private sewage disposal systems, as well as jeopardizing the safety of ground water supplies. The following sample results reveal the problems encountered in providing adequate disposal for domestic sewage on individual premises to the LaSalle Park area:

Date: June 29, 1959

Sample Point No.	Location of Sample	5 Day B.O.D. p.p.m.	Solids p.p.m.	Total Susp. Diss.	Total Coliform Count per 100 ml. Ind. No.
CC-5	Tributary of Cataraqui Creek at Day's Road in La Salle Park.	70	504	100 404	100,000
CC-4	The above tributary downstream at Hwy. #33.	13	272	34 238	1,000

The above laboratory results reveal the presence of untreated or partially treated sanitary wastes in these flows. There was visual evidence of domestic waste at the time of sampling.

The development of policy for a municipal sewerage system in Kingston Township presently is receiving active consideration but had not yet been completed.

Industrial Outfalls

Two industrial firms located within the Township of Kingston were visited during this survey to determine or review

their method of industrial and sanitary waste disposal. These firms are Dupont Company of Canada(1956) Limited and Vicom and Company(Canada) Limited.

Dupont Company of Canada(1956)Limited

This plant is located on Carruther's Point at Lake Ontario, and draws its water supply from the lake.

Industrial wastes are discharged eastward from this plant into Cataraqui Bay. Members of the Industrial Wastes Section, Ontario Water Resources Commission, have conducted investigations at this plant and have recommended that consideration be given to the removal or satisfactory reduction of phenolic waste from these discharges prior to their disposal to Cataraqui Bay.

Sanitary wastes are discharged to a septic tank. The partially treated effluent from the septic tank is chlorinated prior to its ultimate discharge to Cataraqui Bay.

A report on investigations at Dupont Company of Canada(1956) Limited on June 24th, 1959, has been prepared and distributed to the appropriate persons. The firm has been requested to continue with their programme of improved waste treatment.

Vicom and Company(Canada)Limited

This tool and die works is located in a hangar at the Norman Rogers Aerodrome, and employs approximately 20 persons. Water is drawn from Lake Ontario and, according to the managing-director of Vicom and Company(Canada)Limited, is used without prior treatment.

A concrete septic tank receives the sanitary wastes from the Vicom and Company(Canada)Limited plant as well as sanitary wastes from the Kingston Flying Club premises. The partially treated effluent from this septic tank discharges without further treatment to a ravine and flows into a crevice in the ground. No wells were observed in the immediate area.

Institutional Outfalls

Collins Bay Penitentiary

This penal institution is located on the south side of Bath Road west of Cataraqui Creek. The penitentiary property extends eastward to the west bank of Cataraqui Creek which at this point is the boundary between the City of Kingston and the Township of Kingston. The main compound is located approximately one-half mile from this creek.

Approximately 450 inmates were in custody at this institution. A staff of 130 to 140 persons was employed at the time of this inspection on June 16th, 1959.

Collins Bay Penitentiary obtains its water supply from the Kingston Penitentiary water works system and uses approximately 100,000 Imperial gallons of water per day.

Sanitary and domestic wastes are discharged to a concrete septic tank which has a reported capacity of 8,400 Imperial gallons. A chlorine contact chamber with a reported liquid capacity of 1,785 Imperial gallons is employed inconsistently. Chloride of lime reportedly is applied irregularly to the chlorine contact chamber. The partially treated septic tank effluent discharges to a ditch and flows to

Cataraqui Creek. The laboratory results of samples collected from the sewage flows at Collins Bay Penitentiary are tabulated in Table VII and reveal the need for improved sewage treatment at this institution.

A report on this investigation at Collins Bay Penitentiary, with pertinent recommendations, has been prepared and distributed to the appropriate persons.

Summary

1. The laboratory results of samples collected from the south-western tributary of Cataraqui Creek at Day's Road in LaSalle Park where municipal storm drains terminate on the banks of the stream reveal the presence of sanitary wastes. There was visual evidence of domestic waste at the time of sampling.
2. Dupont Company of Canada(1956)Limited discharges industrial wastes and partially treated sanitary wastes to Cataraqui Bay.
3. Sanitary and domestic wastes at Collins Bay Penitentiary are discharged to a septic tank. The partially treated effluent from this septic tank flows to Cataraqui Creek.
4. The Township of Kingston is considering the development of a policy for a municipal sewerage system.

Recommendations

1. The problems revealed at LaSalle Park with respect to the disposal of sanitary and domestic wastes on individual premises, indicate the need for an overall sewage works

programme.

2. Dupont Company of Canada(1956)Limited should continue with their programme to ensure that all flows from their premises to Cataraqui Bay are adequately stabilized before discharging to a watercourse.

3. Early planning is necessary at Collins Bay Penitentiary to provide adequate treatment for all sanitary and domestic wastes which presently are discharged from this institution to Cataraqui Creek.

Consideration should be given to:

- (a) Discharging sewage from the Collins Bay Penitentiary to the City of Kingston municipal sewer system; or
- (b) Providing a private plant of adequate capacity for complete treatment of the sewage; or
- (c) Consulting with Kingston Township officials and participating in their sewerage system programme if a positive development is imminent; and
- (d) Providing effective chlorination of the effluent which discharges from this institution to Cataraqui Creek.

Chapter IV
FRONTENAC COUNTY

Township of Pittsburgh

General

The Township of Pittsburgh occupies the south-eastern portion of Frontenac County. This triangular-shaped municipality is bordered on the south by the St. Lawrence River, on the west by the Cataraqui River and Rideau Canal System and on the east by the County of Leeds. The Township of Pittsburgh has an assessed area of 48,085 acres, with an approximate population of 3,500 persons.

Geography and Geology

The Township of Pittsburgh is drained by numerous small watercourses to the Cataraqui River and Rideau Canal System, and to the St. Lawrence River.

In that portion of the municipality which borders the major waterways and which therefore is of interest to this survey, the fissured limestone formation is covered by an overburden of heavy clay varying in depth from approximately six(6) feet to only a few inches. It is not surprising that under these conditions, difficulties are experienced with regard to the functioning of private septic tank systems and the associated contamination of ground water supplies.

Economic Growth

Recent residential development within the Township of Pittsburgh has been confined for the most part to the southern area near Highway #2 and the St. Lawrence River. The

military camp with training and residential quarters, is located near the community of Barriefield. Almost immediately to the east of this area is the Ravensview Subdivision along Highway #2. The Cana Subdivision is located west of Highway #45, approximately 4.5 miles north-east of Barriefield.

With respect to Department of National Defence establishments within the municipality, the Royal Military College is located on a peninsula at the mouth of the Cataraqui River. H.M.C.S. Cataraqui and associated adjacent buildings are located north of Highway #2, east of LaSalle Causeway. The aforementioned military camp situated east of the community of Barriefield includes the Barriefield camp, the R.C.E.M.E. quarters, Vimy R.C.C.S., and at Fort Henry Heights, the permanent quarters for married personnel.

The Joyceville Institution is located near the Cataraqui River, approximately eleven(11) miles upstream from the river's mouth, near the community of Joyceville.

Old Fort Henry is located near the St. Lawrence River, immediately west of the military area. This historic site is administered by the Ontario-St. Lawrence Development Commission.

Industrial growth within the Township of Pittsburgh has been limited in extent.

Recreational Sites

Recreational use of waters along the borders of Pittsburgh Township appears to concentrate in the St. Lawrence River, and is associated mainly with private residences. A Y.M.C.A. Day Camp is located approximately one(1) mile east of

the City of Kingston sewage treatment plant.

Water Supplies

No municipal water works systems exist in the Township of Pittsburgh. Due to its predominantly rural nature most of the municipality is served by private well supplies.

The Ravensview Subdivision utilizes private wells.

The Cana Subdivision is controlled by the Cana Home Building Co-operative. A community water works system is employed with water being supplied from a well.

All of the National Defence establishments as well as Old Fort Henry in Pittsburgh Township receive their water supply from the City of Kingston municipal water distribution system.

In that part of the municipality which lies near the community of Barriefield, difficulties reportedly have been experienced with regard to contaminated private well supplies, and the presence of sulphur and chlorides in the ground waters.

Sewage Disposal

The residential areas in Pittsburgh Township are served by private septic tank systems with some exceptions. New installations are supervised by Mr.D.Bruce, R.R.#1, Kingston, Pittsburgh Township Building Inspector.

The Ravensview Subdivision employs private septic tank systems.

A community septic tank system with underdrained tile beds receives sewage flows are the Cana Subdivision. Effluent from the underdrains seeps to the Cataraqui River. The

unsatisfactory bacteriological and sanitary chemical qualities of this seepage is reflected in the following laboratory results of a sample collected on June 9, 1959:

Sample Point No.	Lab. No.	5 Day B.O.D. p.p.m.	Solids p.p.m. Total	Sus. Diss.	Total Coliform Count per 100 ml. Indicated No.	
PT	2582	198	1608	176	1432	1,000,000

An inspection of these sewage disposal works on June 9th and 10th, 1959, by Mr.G.Kay, District Engineer of this Commission, revealed a malfunctioning system. Appropriate recommendations have been made by Mr.Kay.

The Barriefield Military Camp is served by the City of Kingston municipal sewerage system. A private sewage pumping station located near the Cataraqui River reportedly with an emergency overflow thereto, is employed to pump part of the sewage flows from these military premises, where a gravity flow is not possible, to the city trunk sewer. The remainder of these military premises discharge sewage flows by gravity to the city trunk sewer and thence to the City of Kingston sewage treatment plant.

The Royal Military College presently discharges all sewage without prior treatment to the mouth of the Cataraqui River. Samples of this discharge were collected at the manhole in the outfall sewer on June 15, 1959. The following laboratory results reveal the need for treatment of these wastes:

Sample Point No.	Lab. No.	5 Day B.O.D. p.p.m.	Solids p.p.m. Total Susp. Diss.		Total Coliform Count per 100 ml. Ind.No.
PS	2763	164	342	66 276	10,000,000+

The Department of National Defence is constructing a sewage pumping station on Royal Military College premises to deliver all sewage flows from the Royal Military College and H.M.C.S. Cataraqui, over the height of land at Barriefield to the City of Kingston municipal trunk sewer. H.M.C.S. Cataraqui reportedly is presently served by a septic tank and tile bed system.

An investigation of the sewage disposal facilities at Old Fort Henry on June 13th, 1959, did not reveal that any sanitary wastes from these premises reach the waterfront. Two (2) septic tanks and associated disposal beds reportedly are employed.

A private sewage treatment plant has been constructed to serve the Joyceville Institution. Facilities will provide complete sewage treatment as well as chlorination of the effluent prior to its discharge to the Cataraqui River.

Industry

The only industrial activity observed within the Township of Pittsburgh, which could be of interest to this survey, was the Gus Marker Ready Mixed Limited gravel-washing operation in Concession Three approximately four (4) miles north-east of the City of Kingston. Water for gravel-washing purposes is pumped from an inlet of the Cataraqui River. Liquid wastes from the washing of gravel are discharged to a

lagoon for retention to permit the settling of suspended material. Effluent from the lagoon flows to a marshy area, but on July 21st, and August 31st, 1959, did not appear to be gaining entrance to the local inlet of the Cataraqui River.

Sample Results

"Grab" samples were collected at two(2) locations within the Township of Pittsburgh during this survey. The laboratory results of samples collected from the drainage from the Cana Subdivision sewage disposal system to the Cataraqui River, and from the Royal Military College sewage discharge to the mouth of the Cataraqui River, have been incorporated earlier in this report, but also have been tabulated in Table X. The locations of sampling points are shown on the appended map of the Township of Pittsburgh.

The laboratory results of a sample collected from the creek which flows into the St. Lawrence River at the Y.M.C.A. Day Camp are shown in Table III. The flow in this creek was very limited during sampling on August 26th, 1959, when a bacteriological content of 95,000 coliform organisms per 100 ml., when tested by the Membrane Filter method, was revealed.

Recommendations

Frequent supervision and adequate maintenance of the community sewage disposal system at the Cana Subdivision is necessary to prevent inadequately treated sewage from discharging from these premises to the Cataraqui River.

Early completion of the sewage pumping station which will serve the Royal Military College and H.M.C.S. Cataraqui should be accomplished in order that sewage flows from the Royal Military College may be discharged to the City of Kingston sewage treatment plant rather than directly to the waterfront.

The local Medical Officer of Health should ensure that the small creek which flows into the St. Lawrence River near the Y.M.C.A. camp does not receive untreated or inadequately treated sanitary wastes.

RIVER SURVEY

Lake Ontario-St. Lawrence River

Sampled by: R. Fuller

All analyses reported in p.p.m. unless otherwise indicated.

Sample Point No.	Lab. No.	Date 1959	5 Day B.C.D.	Total	Solids		Turb- idity	Bacteriological	
					Susp.	Diss.		Lab.No.	M.F. Coliform Count/100 ml.
Br.1	R349	June 10	1.5	192	8	184	2	R383	less than 10
Br.2	R350	June 10	2.2	184	4	180	2	R384	100
Br.3	R351	June 10	2.1	184	4	180	2	R385	less than 10
A	R341	June 10	1.7	158	8	150	2	R375	100
B	R342	June 10	2.4	194	4	190	2	R376	less than 10
C	R343	June 10	1.1	184	4	180	2	R377	40
D	R344	June 10	1.8	180	8	172	2	R378	less than 10

Table I
- 61 -

For locations of sampling points see appended map of "Lake Ontario and St. Lawrence River along the front of Frontenac County".

RIVER SURVEY

Lake Ontario-St. Lawrence River

Sampled by: R.Fuller

All analyses reported in p.p.m. unless otherwise indicated.

Sample Point No.	Lab. No.	Date 1959	5 Day B.O.D.	Solids Total Susp. Diss.			Turbidity	Total Coliform Count per 100 ml. Ind. No.	Bacteriological Lab. No. M.F.C. Coliform Count	
E	R345	June 10	2.3	202	6	196	2		R381	less than 10
F	R346	June 10	1.6	188	8	180	2		R380	50
G	R336	June 10	2.3	152	8	144	3		R372	250
G(depth sample)	R337	June 11	2.0	192	6	186	2	10	S851	
H	R338	June 11	1.0	154	4	150	2		R373	less than 10
H(depth sample)	R339	June 11	1.2	158	8	150	2	100	S852	
J	R340	June 11	2.3	170	10	160	2		R374	less than 10
K	R324	June 11	1.3	174	8	166	2		R360	42,000
L	R325	June 11	1.1	236	6	230	2		R361	23,000
M	R326	June 11	1.6	232	6	226	3		R362	40
N	R327	June 11	1.4	134	6	128	2		R363	100
O	R328	June 11	1.2	234	6	228	3		R364	less than 10
P	R330	June 11	1.5	236	6	230	3		R365	20

Table I (continued)

RIVER SURVEY

Lake Ontario-St. Lawrence River

Sampled by: R. Fuller

All analyses reported in p.p.m. unless otherwise indicated.

Sample Point No.	Lab. No.	Date 1959	5 Day B.O.D.	Solids			Turb- idity	Bacteriological	
				Total	Susp.	Diss.		Lab. No.	M.F. Coliform Count/100 ml.
Q	R330	June 11	1.5	194	6	183	2	R366	less than 10
R	R331	June 11	2.4	200	6	194	2	R367	greater than 150,000
S	R332	June 11	1.6	168	8	160	2	R368	90,000
T	R333	June 11	1.6	186	6	180	2	R369	100
U	R334	June 11	1.3	158	8	150	2	R370	less than 10
V	R335	June 11	1.1	186	6	180	3	R371	54,000

RIVER SURVEY

St. Lawrence River near Kingston S.T.F.
(Frontenac County)

Sampled by: R. Fuller
Date: August 26, 1959.

All analyses reported in p.p.m. unless otherwise indicated.

Lab. No.	5 Day B.O.D.	Solids			Turb- idity	Bacteriological	
		Total	Susp.	Diss.		Lab. No.	M.F. Coliform Count/100 ml.
R 1417	1.4	178	--	--	4	R 1750	3,100
R 1418	1.3	218	--	--	4	R 1751	13,100
R 1419	1.2	218	--	--	5	R 1752	600
R 1420	0.9	200	--	--	3	R 1753	12,600
R 1421	0.8	182	--	--	3	R 1754	10
R 1422	0.9	182	--	--	3	R 1755	6
R 1423	1.2	188	--	--	4	R 1756	19
R 1424	1.3	182	--	--	4	R 1757	15

Table II

- 64 -

R 1417	#1	St. Lawrence River-	near City of Kingston S.T.P.
R 1418	#2	St. Lawrence River-	" " " " "
R 1419	#3	St. Lawrence River-	" " " " "
R 1420	#4	St. Lawrence River-	" " " " "
R 1421	#5	St. Lawrence River-	" " " " "
R 1422	#6	St. Lawrence River-	" " " " "
R 1423	#7	St. Lawrence River-	" " " " "
R 1424	#8	St. Lawrence River-	" " " " "

RIVER SURVEY

St. Lawrence River near Kingston S.T.P.
(Frontenac County)

Sampled by: R. Fuller
Date: August 26, 1959.

All analyses reported in p.p.m. unless otherwise indicated.

Lab. No.	5 Day B.C.D.	Solids			Turb- idity	Bacteriological	
		Total	Susp.	Diss.		Lab.No.	M.F. Coliform Count/100 ml.
R 1425	1.1	186	--	--	4	R 1758	98
R 1426	1.3	182	--	--	4	R 1759	68,000
R 1427	1.0	186	--	--	3	R 1760	137,000
R 1428	0.6	190	--	--	4	R 1761	330,000
R 1429	0.9	192	--	--	4	R 1762	97
R 1430	1.1	216	--	--	4	R 1763	21
R 1431	1.3	202	--	--	4	R 1764	13
R 1432	0.8	188	--	--	4	R 1765	0

R 1425 #9 St. Lawrence River- near City of Kingston S.T.P.
 R 1426 #10 St. Lawrence River- " " " "
 R 1427 #11 St. Lawrence River- " " " "
 R 1428 #12 St. Lawrence River- " " " "
 R 1429 #13 St. Lawrence River- " " " "
 R 1430 #14 St. Lawrence River- " " " "
 R 1431 #15 St. Lawrence River- " " " "
 R 1432 #16 St. Lawrence River- " " " "

RIVER SURVEY

St. Lawrence River near Kingston S.T.P.
(Frontenac County)

Sampled by: R. Fuller
Date: August 26, 1959.

All analyses reported in p.p.m. unless otherwise indicated.

Lab. No.	5 Day B.O.D.	Solids			Turb- idity	Bacteriological	
		Total	Susp.	Diss.		Lab.No.	M.F. Coliform Count/100 ml
R 1433	1.6	174	--	--	4	R 1766	0
R 1434	1.4	190	--	--	4	R 1767	9
R 1435	1.3	200	--	--	4	R 1768	19,700
R 1436	1.5	198	--	--	4	R 1769	182,000
R 1437	2.4	198	--	--	4	R 1770	43
R 1438	3.2	244	36	208	--	R 1771	3,300
R 1439	1.0	208	18	190	--	R 1772	95,000
R 1440	1.8	236	32	204	#24	R 1773 R 1774	8,800 3,900

Table II (continued)

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R 1443	#17	St. Lawrence River-	near City of Kingston S.T.P.
R 1434	#18	St. Lawrence River-	" " " "
R 1435	#19	St. Lawrence River-	" " " "
R 1436	#20	St. Lawrence River-	" " " "
R 1437	#21	St. Lawrence River-	" " " "
R 1438	#22	St. Lawrence River-	" " " "
R 1439	#23	St. Lawrence River-	" " " "

#24 End of Dock at "Y" camp- chemical sample broken in transit.
R 1440 #25 Inlet east of "Y" camp dock.

RIVER SURVEY

Principal tributaries of Lake Ontario- St.Lawrence
Waterway along the front of Frontenac County

Sampled by: R.Barrens
Date: See below.

All analyses in parts per million, unless otherwise indicated.

Sample Point No.	Lab. No.	Date 1959	5 Day B.O.D.	Solids Total Susp.Diss.			Turb-idity	Total Coli- form Count /100 ml.Ind.No.	Bacteriological Lab. M.F.Coliform No. Count/100 ml.	
CB 1	R 348	June 11	2.1	186	6	180			R 382	250
CB 2	2771	June 15	1.2	220	--	--	4	1000	S 948	
CC 1	2772	June 15	4.2	206	--	--	35	100	S 949	Table III - 67 -
CC 2	2773	June 15	6.2	266	--	--	18	10	S 950	
CC 3	3024	June 24	18	344	40	304		1000	S 1039	
CC 4	2776	June 15	2.2	374	--	---	5	10	S 953	
CC 5	3088	June 29	13	272	34	238		1000	S 1059	
CC 6	3087	June 29	70	504	100	404		100,000	S 1058	

Collins Bay

CB 1 R 348 Mouth of Collins Bay
CB 2 2771 Mouth of Collins Creek

Cataraqui Creek

CC 1 2772 Mouth of Cataraqui Creek
CC 2 2773 Cataraqui Creek at Hwy.#33
CC 3 3024 Cataraqui Creek at Counter Street
CC 4 2776 North-east tributary of Cataraqui Creek upstream from Brookside Farm Dairy outfall
CC 5 3088 South-western tributary of Cataraqui Creek- at Hwy.#33
CC 6 3087 South-western tributary of Cataraqui Creek- at Hay's Road in LaSalle Park

RIVER SURVEY

Principal tributaries of Lake Ontario-St. Lawrence
Waterway along the front of Frontenac County
All analyses in p.p.m. unless otherwise indicated.

Sampled by: R. Barrens
Date: See below.

Sample Point No.	Lab. No.	Date 1959	Phenol ppb.	Alkal- inity CaCO ₃	pH	Chrome Cr	5 Day B.O.D.	Solids Total Susp.	Diss.	Turb- idity	Total coli- form Count /100 ml.	Ind. No.	Bacteriological Lab. M.F. Coli- No. form Count
CR 1	2784	June 15	3.0	85	8.5	0	2.8	156	--	--	11	1000	S961 --
CR 2	2785	June 15	0	84	8.5	0	1.8	144	--	--	3	1000	S962 --
CR 3	2786	June 15	0	87		0	1.7	170	--	--	--	100	S963 --
CR 4	R157	May 27	0	71	8.6	--	1.7	122	--	--	4	--	R217 1
	R205	May 28	2	--	7.9	--	2.5	114	--	--	5	--	R 247 3
CR 5	2661	June 13					1.4	84	4	80		1000	S871 --
CR 6	2583	June 13					1.2	104	8	96		0	S833 --
23	R1439	Aug. 26	(Bacteriological only)										R1772 95,000

Cataraqui River

CR 1 2784 West opening- LaSalle Causeway
CR 2 2785 Centre opening- LaSalle Causeway
CR 3 2786 East opening- LaSalle Causeway
CR 4 R157
R205 Cataraqui River- off Bell Island
CR 5 2661 Cataraqui River at Hwy. #401
CR 6 2583 Cataraqui River at Kingston Mills

Creek at Y.M.C.A. Camp- Pittsburgh Township

23 R1439 Mouth of Creek to St. Lawrence River at Y.M.C.A. Camp

All analyses in p.p.m.

All analyses in p.p.m.

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SEWAGE ANALYSIS

Municipality: City of Kingston
Source: Municipal combined sewer overflows

Sampled by: R.Barrens
Date: See below

All analyses reported in p.p.m. unless otherwise indicated.

<u>Sample Point No.</u>	<u>Lab. No.</u>	<u>Date 1959</u>	<u>5 Day B.O.D.</u>	<u>Solids Total Susp. Diss.</u>			<u>Lab. No.</u>	<u>Total Coliform Count per 100 ml. Ind.No.</u>
21 C	2630	June 11	100	464	146	318	S 846	10,000,000+
28C	2626	June 11	169	734	426	308	S 842	100,000

21 F 2630 Municipal sewer overflow to Lake- foot of Beverley St.
28 C 2626 Municipal sewer overflow- foot of Gore Street- vicinity sample.

All analyses reported in part 1

All analyses reported in part 2

SEWAGE ANALYSIS

Municipality: City of Kingston
Source: Municipal combined sewer overflows

Sampled by: R.Barrens
Date: See below

IA All analyses reported in p.p.m.unless otherwise indicated.

Sample Point No.	Lab. No.	Date 1959	5 Day B.O.D.	Solids Total Susp. Diss.			Turbidity Silica Units	Lab. No.	Total Coliform Count per 100 ml. Ind.No.
32 C	2627	June 11	570	756	152	604		S 843	10,000,000+
36 C	2628	June 11	940	2012	1616	486		S 844	10,000,000+
43 C	2629	June 11	70	336	80	256		S 845	10,000,000+
	2779	June 15	7	420	--	--	15	S 956	1,000,000

2627 Municipal sewer overflow from Johnston St.to Lake- sampled at manhole below Ontario St.
2628 Municipal sewer overflow from Queen St. to Lake- at manhole above outfall.
2629 Municipal sewer overflow from Charles St.to Cataraqui R. at manhole near river.
2779 Drain near Hickson Ave.to Cataraqui River.

Table IV (continued)

analyses reported in p.p.m. 2.75

analyses reported in p.p.m. 2.75

SEWAGE ANALYSIS

Municipality: City of Kingston

Source: Municipal Storm Drain Outfalls

All results reported in p.p.m. unless otherwise indicated.

Sampled by: R. Barrens

Date: See below

Sample Point No.	Lab. No.	Date 1959	5 Day B.O.D.	Total Solids	Susp.	Diss.	Lab. No.	Total Coliform Count per 100 ml. Ind. No.
4 DS	3029	June 24	8.8	470	80	390	S 1044	10,000
9 DS	3023	June 23	16	384	10	374	S 1038	100
15 WS	2787	June 15	Sample broken in transit				S 964	10,000,000+
	3020	June 24	97	566	40	526	S 1035	1,000,000
19 W	2625	June 11	0.9	248	10	238	S 841	0

3029 Ditch to Cataraqui Creek, opposite Glengary Road

3023 Ditch to tributary of Cataraqui Creek- south side of Bath Road

2787 Municipal storm drain to Lake Ontario near foot of Yonge Street

3020 - through improved section of Fortsmith Creek.

2625 Storm drain to Lake from foot of Morton Street.

All results reported in p. 207

All results reported in p. 207

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SE AGE ANALYSIS

Municipality: City of Kingston

Source: Municipal Storm Drain Outfalls

All analyses reported in p.p.m.unless otherwise indicated.

Sampled by: R.Barrens

Date: See below

Sample Point No.	Lab. No.	Date 1959	5 Day B.O.D.	Solids			Lab. No.	Total Coliform Count per 100 ml. Ind.No.
				Total	Susp.	Diss.		
12 PS	2656	June 13	4	196	6	190		100,000
13 PT	2657	June 13	2.4	156	4	152		100,000
14 P	2632	June 11	5.9	184	6	178		1,000
	2658	June 13	3.6	288	72	216		1,000
11 PS	2659	June 13	13	288	46	242		10,000

- 2656 Ontario Hospital- samples collected in vicinity of west outfall(possible bypass of S.T.P.)
 2657 Ontario Hospital- samples collected in vicinity of centre outfall(reported discharge from S.T.P.)
 2632 Ontario Hospital- samples collected in vicinity of east outfall.
 2658 Ontario Hospital- samples collected from east outfall(reported boiler room drainage).
 2659 Drain to Cataraqui Bay from Ontario Hospital Farm(Newcourt) and Cataraqui Golf and Country Club.

All analyses reported

All Analyses Reported

SEWAGE ANALYSIS

Municipality: City of Kingston

Source: Industrial outfalls to watercourses

Sampled by: R.Barrens

Date: See below

All analyses reported in r.p.m.unless otherwise indicated.

Sample Point No.	Lab. No.	Date 1959	5 Day B.O.D.	Solids Total	Susp.	Diss.	Phenol ppb.	Acidity CaCO ₃	Chrome Cr	Lab. No.	Total Coliform Count per 100 ml. Ind.No.
1 PI	2775	June 15	73	870	68	802				S952	100,000
29 PS	3032	June 24	13	204	12	192				S1047	10,000,000+
31 PS	3034	June 24	2.2	178	6	172				S1049	10,000
30 PS	3035	June 24	4.2	186	8	178				S1050	1,000
Membrane Filter Coliform Count per 100 ml.											
45 PSI	R156	May 27	110	2916	138	2778			80		10
	R221	May 28	212	3624	372	3252	250	225	120		90
50 PSI	3061	June 25	27	1028	706	322					1000

2775 Effluent from Brookside Farm Dairy to Cataraqui Creek

3032 Canadian Locomotive Co.Ltd.- outfall from erecting shop washroom vicinity sample

3034 Canadian Locomotive Co.Ltd.- discharge from washroom- south side fabrication office

3035 Main 18-inch sewer from Canadian Locomotive Co.Ltd. vicinity of submerged outfall

R156 A.Davis and Son Limited Tannery discharge to Cataraqui River

R 221 pH at lab.- 6.9

3061 Combined discharge from Frontenac Floor and Wall Tile and Globelite Batteries to small local tributary of Cataraqui River.

pH at lab.- 7.9

Acidity as CaCO₃ - --

Lead as pb.- 4.5

* All analyses reported in 1945. * All analyses reported in 1945.

Figure 1. Schematic representation of the experimental design. The subjects were divided into two groups: the control group and the experimental group. The control group received a standard diet, while the experimental group received a diet supplemented with 0.5% of the active ingredient. The subjects were then subjected to a 12-week period of physical training. The results of the study are presented in the table below.

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222

2. 证明: 若 $f(x)$ 在 $[a, b]$ 上连续, 且 $f(a) = f(b)$, 则存在 $\xi \in (a, b)$, 使得 $f'(\xi) = 0$.

All analysis reported will be as follows:

SEWAGE ANALYSIS

Municipality: City of Kingston

Source: Military outfalls

Sampled by: R. Parrens

Date: June 15, 1959

A All analyses reported in p.p.m. unless otherwise indicated.

Sample Point No.	Lab. No.	5 Day B.O.D.	Solids Total Susp.	Diss.	Turbidity in Silica Units	Total Coliform Count per 100 ml. Ind.No.
18 PS -	2769	1.4	222	--	2	100
	2768	1.4	182	--	1	100
	2767	1.3	184		2.0	10
38 PS	2766	2	242		4	10,000,000+
39 F	2765	1.3	178		4	1,000
40 PS	2764	1.3	182		5	100

2769 Lake Ontario- 10 ft. offshore, west side of area headquarters.
2768 Lake Ontario- in vicinity of main outfall from area headquarters.
2767 Lake Ontario- in vicinity of east outfall from area headquarters.
2766 South-east outfall from Fort Frontenac to Kingston Harbour- vicinity sample.
2765 East outfall from Fort Frontenac to Kingston Harbour- vicinity sample.
2764 Submerged outlet from Sergeants' Mess to Harbour- vicinity sample.

analyses reported in P.P.M. 1-1-1

analyses reported in P.P.M. 1-1-1

analyses reported in P.P.M. 1-1-1

SEWAGE ANALYSIS

Municipality: Twp.of Kingston

Source: Outfalls to watercourses- for locations refer to
map of Twp.of Kingston.

All analyses reported in p.p.m. unless otherwise indicated.

Sampled by: R.Barrens

Date: See below

Sample Point No.	Lab. No.	Date 1959	5 Day B.C.D.	Total	Solids Susp.	Diss.	Phenol ppb.	Total Coliform Count per 100 ml. Ind.No.
CC 6	3087	June 29	70	504	100	404		100,000
PSI	3026	June 24	38	222	24	198	3	10
PI	3027	June 24	10	952	20	932	3	0
FT	2782	June 16	360	548	188	360		10,000,000+

Table IX - 75 -

3087 South-western tributary of Cataraqui Creek at Day's Road in LaSalle Park- contains
municipal drainage flows.

3026 North outfall from Dupont Company of Canada(1956)Limited- to Cataraqui Bay.

3027 South outfall from Dupont Company of Canada(1956)Limited- to Cataraqui Bay.

2782 Effluent from Collins Bay Penitentiary sewage treatment plant to Cataraqui Creek.

All analyses reported in progress

All analyses reported in full

1950, 1951, 1952

Other for other will be of the same type as the above, but the results will be reported in full. The data for the above are given in the following table. The data for the other are given in the following table.

SEWAGE ANALYSIS

Municipality: Township of Pittsburgh
Source: Outfalls to watercourses- for sampling locations
refer to map of Twp.of Pittsburgh

Sampled by: R.Barrens
Date: See below

All results reported in p.p.m.unless otherwise indicated.

<u>Sample Point No.</u>	<u>Lab. No.</u>	<u>Date 1959</u>	<u>5 Day B.O.D.</u>	<u>Solids Total</u>	<u>Susp.</u>	<u>Diss.</u>	<u>Total Coliform Count per 100 ml. Ind.No.</u>
PT	2582	June 9	198	1608	176	1432	1,000,000
PS	2763	June 15	164	342	66	276	10,000,000+

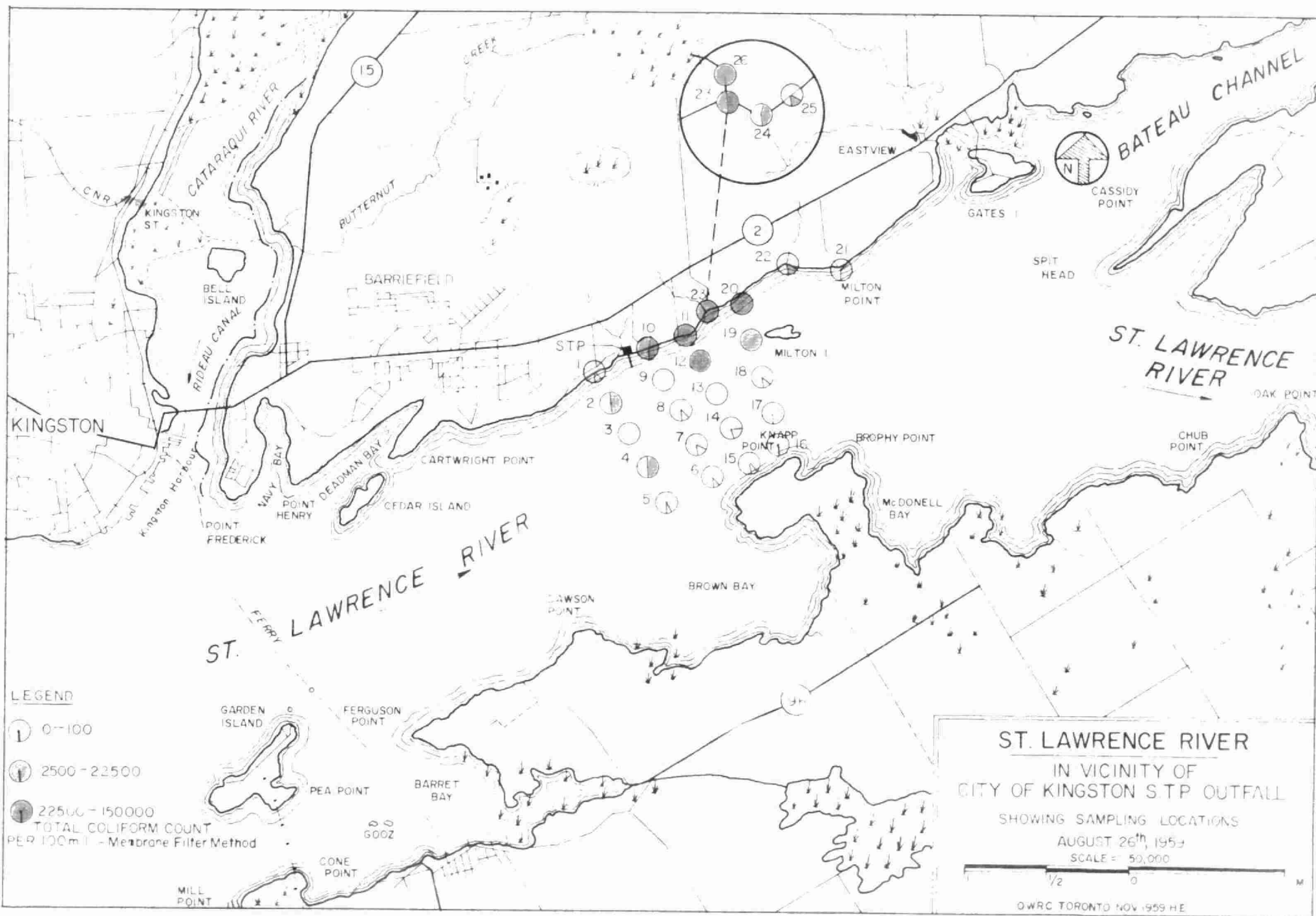
2582 Drainage from sewage disposal system at Cana Subdivision to Cataraqui River.

2763 Sewage discharge from Royal Military College to Cataraqui River (sampled at manhole).

Table X

All results reported in P.R. 6. 1944

All results reported in P.R. 6. 1944







LEGEND

15 - OUTFALL SAMPLES
W.S. - SHOWING SEQUENCE NUMBER AND TYPE

TYPE OF EFFLUENT

- D - WATER (OPEN DITCH)
- W - WATER (STORM SEWER)
- T - TREATED SEWAGE
- S - UN-TREATED OR PARTIALLY TREATED SEWAGE
- C - COMBINED SEWER
- I - INDUSTRIAL WASTE
- P - PRIVATE OUTFALL
- S.P.S. - SEWAGE PUMPING STATION
- - MUNICIPAL TRUNK SEWER

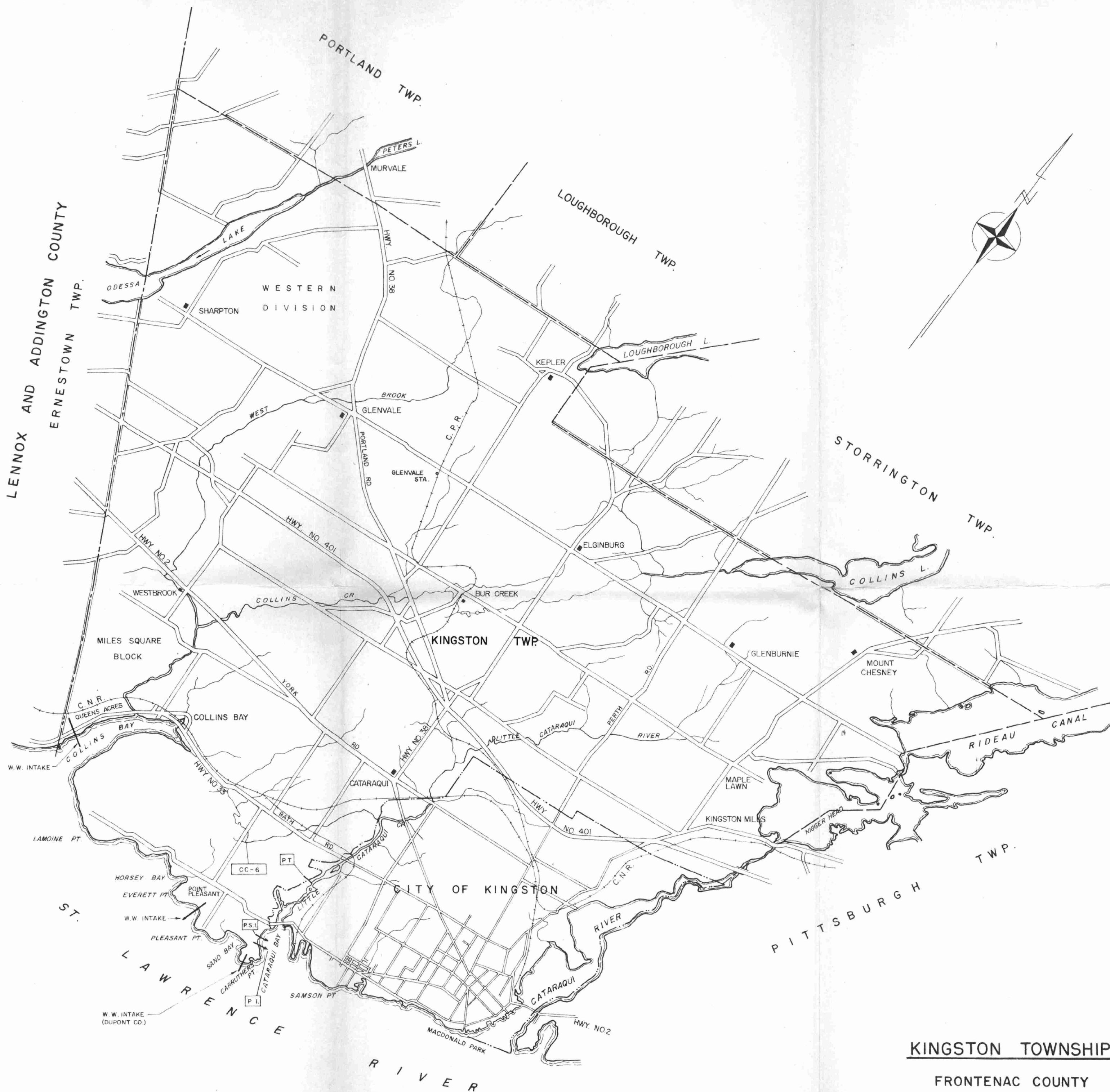
CITY OF KINGSTON

SANITARY SURVEY - 1959

SCALE 1" = 600'

0 200 400 600 800 1000

DATE: MARCH 1959 S.H.



KINGSTON TOWNSHIP

FRONTENAC COUNTY

SANITARY SURVEY — 1959

- LEGEND**
- CC-6 — STREAM SAMPLING POINT
 - SHOWING STREAM AND MILEAGE
 - P.T. — EFFLUENT SAMPLING POINT
 - TYPE OF EFFLUENT:
 - P — PRIVATE OUTFALL
 - T — TREATED SEWAGE
 - S — UNTREATED OR PARTIALLY TREATED SEWAGE
 - I — INDUSTRIAL EFFLUENT
 - COUNTY BOUNDARY
 - TOWNSHIP BOUNDARY
 - CITY LIMITS

SCALE: 1" = 1 MILE



(9398)

MOE/KIN/SUR/ANDH

DATE DUE		

MOE/KIN/SUR/ANDH + 4 maps
Ontario Water Resources Co
A survey of the
outfalls to lake Ontario and
the St. Lawrence River and
C.I. a aa